

Algebra Review on Solving Systems of Linear Equations

Name Key Date _____

GRAPHING

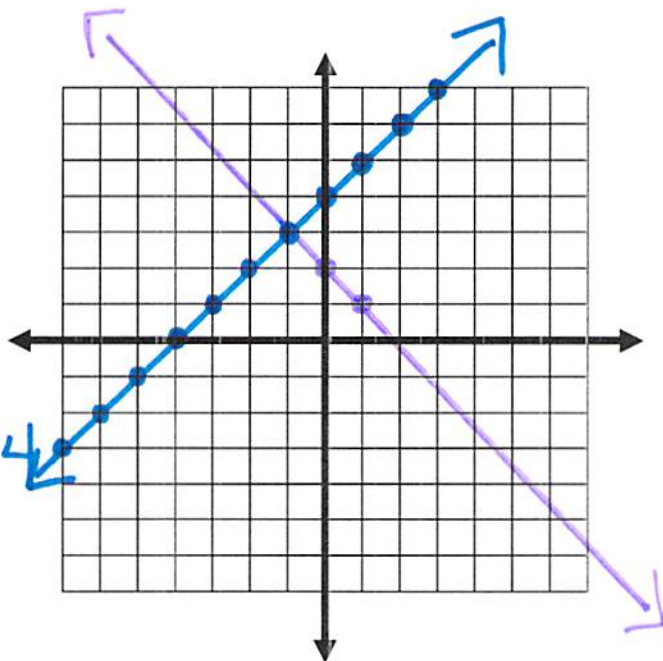
- 1) Make sure each equation is in slope - intercept form: $y = mx + b$
- 2) Graph each equation on the same coordinate plane.
- 3) The point where the lines intersect is the solution.
 - If the lines are parallel and don't intersect then there is NO SOLUTION.
 - If the lines coincide (same equation so one line lies on top of the other) then there are INFINITELY MANY SOLUTIONS.

Example: $y - x = 4$
 $y + x = 2$

$$\begin{array}{r} y - x = 4 \\ +x \quad +x \\ \hline y = x + 4 \end{array}$$

$$m = \frac{1}{1}$$

$$y\text{-int.} = 4$$



$$\begin{array}{r} y + x = 2 \\ -x \quad -x \\ \hline y = -x + 2 \end{array}$$

$$m = \frac{-1}{1}$$

$$y\text{-int.} = 2$$

$(-1, 3)$

SUBSTITUTION

- 1) Solve one equation for either X or Y.
- 2) Substitute the expression from Step 1 into the other equation and solve for the remaining variable.
- 3) Substitute the value from Step 2 into the equation from Step 1 and solve for the variable.
- 4) Your solution is an ordered pair (x, y).
 - If the variable cancels out while in the process of solving, look at what remains on each side of your equation.
 - If what remains is TRUE ($4 = 4$) then your answer is INFINITELY MANY SOLUTIONS.
 - If what remains is FALSE ($0 \neq 4$) then your answer is NO SOLUTION.

1. $x + 6y = 18$ •
 $2x - 3y = -24$

$$(-6, 4)$$

2. $-x + y = 1$ •
 $x - y = 1$

$$\begin{array}{r} x + 6y = 18 \\ -6y \quad -6y \\ \hline \end{array}$$

$$x = 18 - 6y$$

$$\begin{array}{l} x = 18 - 24 \\ x = -6 \end{array}$$

$$2(18 - 6y) - 3y = -24$$

$$36 - 12y - 3y = -24$$

$$\begin{array}{r} 36 - 15y = -24 \\ -36 \quad -36 \\ \hline \end{array}$$

$$\begin{array}{r} -15y = -60 \\ -15 \quad -15 \\ \hline \end{array}$$

$$y = 4$$

$$\begin{array}{r} -x + y = 1 \\ +x \quad +x \\ \hline y = 1 + x \end{array}$$

$$x - (1 + x) = 1$$

$$x - 1 - x = 1$$

$$-1 \neq 1$$

No solution

ELIMINATION

- 1) Arrange the equations with like terms in columns.
- 2) You want one variable to have opposite coefficients. So if necessary, multiply one or both of the equations by a number to create opposite coefficients for a variable.
- 3) Add the two equations together (adding like terms in columns) to eliminate a variable.
- 4) Solve for the variable that remains.
- 5) Substitute the value from Step 4 into one of the original equations to solve for the other variable.
- 6) The solutions will be an ordered pair (x, y) .
 - If both variables cancel out while in the process of solving, look at what remains on each side of your equation.
 - If what remains is TRUE ($4 = 4$) then your answer is INFINITELY MANY SOLUTIONS.
 - If what remains is FALSE ($0 \neq 4$) then your answer is NO SOLUTION.

$$\begin{array}{r} x - y = 7 \\ 1+ 2x + y = -10 \end{array}$$

$$\frac{3x}{3} = \frac{-3}{3}$$

$$x = -1$$

$$\begin{array}{r} -1 - y = 7 \\ +1 \quad +1 \end{array}$$

$$\frac{-y}{-1} = \frac{8}{-1}$$

$$y = -8$$

$$(-1, -8)$$

$$\begin{array}{l} 2(2x + 5y = -2) \\ 2(5x - 2y = 24) \end{array}$$

$$(4, -2)$$

$$\begin{array}{r} +4x + 10y = -4 \\ 25x - 10y = 120 \end{array}$$

$$\frac{29x}{29} = \frac{116}{29}$$

$$x = 4$$

$$\begin{array}{r} 8 + 5y = -2 \\ -8 \quad -8 \end{array}$$

$$\frac{5y}{5} = \frac{-10}{5}$$

$$y = -2$$

Practice Solving Algebraically (Substitution or Elimination)

$$1. \begin{array}{l} 2x + y = 11 \\ x + y = 9 \end{array} \bullet$$

$$(2, 7)$$

$$\begin{array}{r} -y - y \\ \hline \end{array}$$

$$x = 9 - y$$

$$\begin{array}{l} x = 9 - 7 \\ x = 2 \end{array}$$

$$2(9 - y) + y = 11$$

$$18 - 2y + y = 11$$

$$\begin{array}{r} 18 - y = 11 \\ -18 \quad -18 \\ \hline \end{array}$$

$$y = 7$$

$$\begin{array}{r} -y = -7 \\ -1 \quad -1 \\ \hline \end{array}$$

$$3. \begin{array}{l} y + 2x = 5 \\ -3y - 6x = -15 \end{array} \bullet$$

$$\begin{array}{r} y + 2x = 5 \\ -2x \quad -2x \\ \hline \end{array}$$

$$y = 5 - 2x$$

$$-3(5 - 2x) - 6x = -15$$

$$-15 + 6x - 6x = -15$$

$$-15 = -15$$

Infinitely many solutions

$$2. \begin{array}{l} 2x + 3y = 8 \\ 3(5x - y = 3) \end{array}$$

$$(1, 2)$$

$$\begin{array}{r} 15x - 3y = 9 \\ + 2x + 3y = 8 \\ \hline \end{array}$$

$$\frac{17x}{17} = \frac{17}{17}$$

$$x = 1$$

$$\begin{array}{r} 5 - y = 3 \\ -5 \quad -5 \\ \hline \end{array}$$

$$y = 2$$

$$5(4x - 9y = 1)$$

$$4(-5x + 6y = 4)$$

$$(-2, -1)$$

$$\begin{array}{r} 20x - 45y = 5 \\ + -20x + 24y = 16 \\ \hline \end{array}$$

$$\begin{array}{r} -21y = 21 \\ -21 \quad -21 \\ \hline \end{array}$$

$$y = -1$$

$$\begin{array}{r} 4x + 9 = 1 \\ -9 \quad -9 \\ \hline \end{array}$$

$$\frac{4x}{4} = \frac{-8}{4}$$

$$x = -2$$